

The Genera *Moelleria* Jeffreys, 1865, and  
*Spiromoelleria* gen. nov. in the North Pacific, with  
Description of a New Species of *Spiromoelleria*  
(Gastropoda: Turbinidae)

by

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*Abstract.* Two genera of minute turbinid gastropods in the subfamily Homalopomatinae, *Moelleria* Jeffreys, 1865, and *Spiromoelleria* gen. nov., are here called the *Moelleria* group. These genera differ from other homalopomatine genera in having a calcareous operculum with a multispiral pattern on its exterior surface, having the operculum unable to retract deeper than flush with the apertural margin, and lacking the apertural denticle of *Homalopoma* and related genera. *Moelleria* is monotypic for *M. costulata* (Möller, 1842), which has a circumboreal, offshore distribution. It has coalescing axial sculpture of a kind unknown in other living trochacean genera. Spiral sculpture is characteristic of only two shallow-water North Pacific species in the new genus *Spiromoelleria*: *S. quadrae* (Dall, 1897), the type species, and *S. kachemakensis* spec. nov. *Moelleria drusiana* Dall, 1919, is synonymized with *S. quadrae*. The three species are sympatric in the Gulf of Alaska.

## INTRODUCTION

TWO SPECIES until now assigned to *Moelleria* Jeffreys, 1865, have major differences in sculpture, although these differences have not previously been thought to merit generic distinction. The discovery of a third, new species, conforming to one of the sculptural types, indicates that the two basic kinds of sculpture should be distinguished at the generic level. We, therefore, propose the new genus *Spiromoelleria*, which now includes two species; *Moelleria* remains monotypic.

The two genera differ in shell and opercular characters from genera related to *Homalopoma* Carpenter, 1864, at a level that will be treated as a tribe in a review of trochacean classification (McLean & Hickman, in preparation). In this paper we discuss these distinctions but refer to the two genera as the *Moelleria* group. The new genus

and species have already been included in a checklist of the mollusks of Alaska (BAXTER, 1983); they are first validated here.

Collections examined include those of Rae Baxter (RB), the University of Alaska, Fairbanks (UAF), the California Academy of Sciences, San Francisco (CAS), the Los Angeles County Museum of Natural History (LACM), and the National Museum of Natural History, Washington, D.C. (USNM). Voucher specimens of *Moelleria costulata*, *Spiromoelleria quadrae*, and *Homalopoma lacunatum*, and paratypes of *S. kachemakensis*, have been deposited in these institutions and in the National Museum of Canada (NMC).

Shells are illustrated by macrophotography and scanning electron microscopy (SEM). Radulae of two species are illustrated with SEM. Living specimens of *S. kachemakensis* were sketched by Baxter under a dissecting mi-

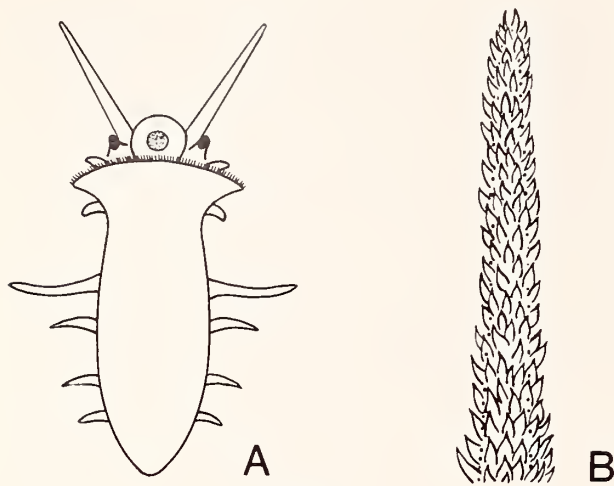


Figure 1

*Spiromoelleria kachemakensis* Baxter & McLean, spec. nov. Drawings of living specimen (by Baxter). A. Ventral view of head, foot, and epipodial structures, showing cephalic tentacles with eyes at base, mouth, foot (anterior tip broad with papillate edge), four pairs of epipodial tentacles, and neck lobes posterior to eyes; B. Enlarged view of cephalic (or epipodial) tentacle, showing papillae.

roscope. Shells were measured with calibration scales for a dissecting microscope.

#### Family TURBINIDAE

##### Subfamily HOMALOPOMATINAE

##### The *Moelleria* Group of Genera

*Moelleria* Jeffreys, 1865, and *Spiromoelleria* gen. nov. have the following shared features:

Shell minute (under 4 mm maximum dimension), depressed, deeply umbilicate; aperture nearly circular, only slightly oblique; columellar denticles lacking; lip not thickened. Sculpture of axial and spiral elements, or spiral elements alone. Interior nacreous layer thin. Protoconch with pointed tip, as in most trochaceans. Operculum not retractable deeper than apertural margin; interior surface of operculum flat, multispiral; exterior surface concave, also multispiral. Cephalic lappets lacking; left and right neck lobes simple; left and right epipodial ridge with four pairs of papillate epipodial tentacles; anterior end of foot with lateral tips. Rachidian tooth narrow at tip and base, broad at midpoint; lateral teeth 5, broad at midpoint and overlapping adjacent laterals; lateromarginal plate attached to base of first marginal; marginal teeth numerous, cusped.

The thin shell, thin nacreous layer, and lack of columellar denticles in the *Moelleria* group are characteristic. Genera related to *Homalopoma* Carpenter, 1864, differ in having thicker shells, a more pronounced nacreous layer, and the outer lip thickened in mature specimens.

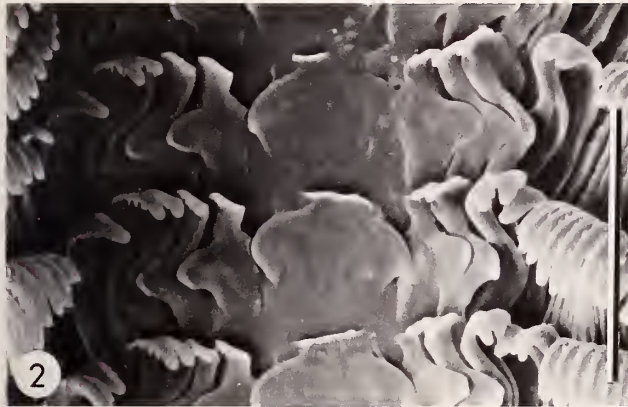
The operculum in the *Moelleria* group is multispiral on both surfaces and unable to retract deeper than flush with the apertural margin. Opercula in genera related to *Homalopoma* differ in having a paucispiral pattern on the interior surface and the exterior surface thickened by calcareous deposition close to the columellar wall, which obliterates the pattern of coiling; these opercula are capable of retracting well within the aperture.

Based on preserved specimens, FRETTER & GRAHAM (1977:93) reported for *Moelleria costulata*: "The snout is broad and depressed, the closed mouth a vertical slit at its end bordered by rather fleshy lips not split or extended mid-ventrally. The tip of the snout is not bilobed but carries a slightly scalloped edge. The tentacles are setose and are flanked laterally by eye stalks each carrying a large black eye at its tip. There are no cephalic lappets. The foot is rather straight anteriorly, its corners elongated, and tapers to a narrow posterior end. A neck lobe lies on each side, smooth-edged, unconnected to the cephalic tentacles but joined to an epipodial fold, carrying (?) 4 tentacles similar to the cephalic ones." The "setae" of Fretter & Graham are equivalent to the "papillae" of CRISP (1981), whose terminology we adopt here.

The living animal of *Spiromoelleria kachemakensis* (Figure 1) is similar to *Moelleria costulata*, as described by FRETTER & GRAHAM (1977). In dorsal view of the extended animal, only the outer portion of the cephalic tentacles and the tips of the first pair of epipodial tentacles show past the shell edge. The short foot is expanded anteriorly and bluntly pointed posteriorly; its anterior margin is finely papillate, the rest of the margin smooth. The cephalic tentacles project about 40% of shell diameter, are papillate, with the pointed, cone-shaped papillae directed anteriorly. The length of the papillae is equal to the diameter of the tentacles near their blunt tips. Along the epipodial fold there are four pairs of elongate, round, blunt-tipped epipodial tentacles, which are papillate like the cephalic tentacles. First epipodial tentacle more than twice the length of the second, the posterior the shortest; their diameter about the same as the cephalic tentacles. Eye spots are black; the eyes are on short stalks, lateral to the cephalic tentacles and are attached to them for about half their length. There are two pairs of neck lobes, which are short, smooth, and triangular in shape. The snout tip is circular, with a rounded central mouth. The operculum on the expanded animal appears to block the umbilical opening. The animal of *S. quadrae* has the posterior region of the foot with fine, short, triangulate papillae, differing from the other species in having the papillae of the tentacles much finer and more numerous.

External anatomical characters are similar to those of *Homalopoma* and related genera (McLean & Hickman, in preparation), which suggests that the *Moelleria* group should be retained in the Homalopomatinae.

Radular ribbons of four specimens of *Moelleria costulata* examined by Baxter had 35 to 44 rows of teeth and 47 to



Explanation of Figures 2 and 3

Figure 2. *Moelleria costulata* (Möller, 1842). Radular ribbon. LACM 73-23, 9 m off Hesketh Island, Kachemak Bay, Cook Inlet, Alaska. Bar = 40  $\mu$ m.

Figure 3. *Spiromoelleria quadrae* (Dall, 1897). Radular ribbon. LACM 73-22, intertidal, Yukon Island, Kachemak Bay, Cook Inlet, Alaska. Bar = 40  $\mu$ m.

54 pairs of marginal teeth. In 12 specimens of *Spiromoelleria quadrae*, there were 46 to 61 rows of teeth and marginal tooth counts of 56 to 78 pairs. For 13 specimens of *S. kachemakensis*, there were 37 to 64 rows of teeth and 43 to 73 pairs of marginal teeth.

Radulae of *Moelleria costulata* (Figure 2) and *Spiromoelleria quadrae* (Figure 3) are illustrated here. SEM illustrations of the radula of *S. kachemakensis* were not made, but the breadth of the rachidian tooth under the light microscope is comparable to that of *M. costulata* (Figure 2). The rachidian appears to be much less developed in *M. costulata* than in *S. quadrae*, but Hickman notes (personal communication) that failure of a shaft and cusp to develop fully is not unusual in many genera and may be characteristic of an entire species or sometimes only of some individuals. The morphology of the lateral and marginal teeth is similar in the two species. In both species, the first marginal is expanded at the base, representing a fusion of the first marginal with the lateromarginal plate. The particular form of the lateromarginal plate in these genera will be discussed in more detail elsewhere by Hickman.

### Genus *Moelleria* Jeffreys, 1865

*Moelleria* JEFFREYS, 1865:292 [as *Mölleria*]. Type species by original designation: *Margarita costulata* Möller, 1842.

The generic and specific descriptions are combined under the species heading, as this genus is monotypic.

A monotypic genus is recognized on the basis of the unique shell sculpture—in which the axial ridges coalesce. Other trochaceans generally have collabral axial ribs, in which a complete rib is produced along the lip edge.

The original spelling *Mölleria* is correctly emended to *Moelleria*.

*Moelleria costulata* has a circumboreal distribution and

is well known, having been most recently discussed by FRETTER & GRAHAM (1977:93).

### *Moelleria costulata* (Möller, 1842)

(Figures 2, 4)

*Margarita costulata* MÖLLER, 1842:81.

*Adeorbis costulata*: STIMPSON, 1851:32; GOULD, 1870:278, fig. 538.

*Cyclostrema (Margarita) costulata*: MÖRCH, 1857:10.

*Mölleria costulata*: JEFFREYS, 1865:291; DAUTZENBERG & FISCHER, 1912:261; THIELE, 1929:65; FRETTER & GRAHAM, 1977:93, figs. 71 (drawing of shell), 72 (SEM view of shell and protoconch).

*Mölleria costulata*: SARS, 1878:127, pl. 9, figs. 8a-c (shell), pl. III, figs. 5a-b (radula); BRÖGGER, 1901: pl. 12, figs. 4a-c.

*Mölleria costulata*: MACGINITIE, 1959:1, pl. 3, figs. 2-5.

*Moelleria costulata*: ODHNER, 1912:19, pl. 5, figs. 43-47; ODHNER, 1915:152; THORSON, 1941:23; CLARKE, 1962: 13; MACPHERSON, 1971:29, pl. 2, fig. 5; ABBOTT, 1974: 61, fig. 501; WARÉN, 1980: pl. 11, fig. 1 (caption only); BAXTER, 1983:28.

*Margarita minutissima* MIGHELS, 1843:349, pl. 16, fig. 5; JOHNSON, 1949:227 (listed only); MACPHERSON, 1971: 29 (as probable synonym of *M. costulata*).

*Margarites (Margarites) minutissimus*: ABBOTT, 1974:37 (listed as valid species).

**Description:** Shell minute, turbinate, deeply umbilicate; aperture and whorls circular; peritreme complete; suture deeply impressed. Whorls 3; sculpture of strong, flat-topped, slightly sigmoid axial ridges, some bifurcating below periphery; interspaces flat-bottomed, variable in width; spiral cords 0 to 9 (on Alaskan specimens), on base and umbilical wall only, variable in strength and spacing, forming nodes on crossing axial ribs. Surface dull, color uniformly brown, tan or gray. Operculum calcareous, exterior surface concave, with up to 6 evenly expanding



Explanation of Figures 4 to 6

Figure 4. *Moelleria costulata* (Möller, 1842). Three views of same specimen. LACM 73-23, 9 m off Hesketh Island, Kachemak Bay, Cook Inlet, Alaska. Height 2.04 mm, diameter 2.34 mm.

Figure 5. *Spiromoelleria quadrae* (Dall, 1897). Three views of same specimen. LACM 73-22, intertidal, Yukon Island, Ka-

chemak Bay, Cook Inlet, Alaska. Height 1.68 mm, diameter 2.46 mm.

Figure 6. *Spiromoelleria kachemakensis* spec. nov. Three views of holotype. LACM 1989, 9 m off Hesketh Island, Kachemak Bay, Cook Inlet, Alaska. Height 1.82 mm, diameter 2.24 mm.

volutions in multispiral pattern; interior surface flat, with same multispiral pattern.

**Dimensions:** Illustrated specimen (Figure 4): height 2.04 mm, diameter 2.34 mm. Shell height 87% of diameter.

**Type material and type localities:** *Moelleria costulata*, type not searched, type locality: Greenland (MÖLLER, 1842). *Margarita minutissima*, type not mentioned by JOHNSON (1949), presumably destroyed in the 1854 fire at Portland Society of Natural History; type locality: Casco Bay, Maine (MIGHELS, 1843).

**Distribution:** Circumboreal in the Arctic Ocean (MACGINITIE, 1959; MACPHERSON, 1971; ODHNER, 1912). Alaskan distribution from Attu, Aleutian Islands (LACM) (52°49'N, 172°10'E), to Turner Bay, Taku Inlet, southeastern Alaska (UAF) (58°19'N, 133°59'W). Atlantic distribution south to Maine, Greenland, Iceland, and Morocco (THORSON, 1941).

**Habitat:** On mud-gravel or mud-shell bottoms, 5 to 1943 m, occasionally common. Living specimens were reported off Point Barrow, Alaska, as deep as 200 m (MACGINITIE, 1959). THORSON (1941) reported a depth of 1943 m off

Morocco. There are, however, no records from such depths in Alaska. Living specimens of *Moelleria costulata* occurred with the type lot of *Spiromoelleria kachemakensis* in Kachemak Bay, Cook Inlet, Alaska.

**Remarks:** MACGINITIE (1959) detailed the extensive shell variation for this species occurring off Point Barrow, Alaska. Specimens from the Gulf of Alaska often lose the axial sculpture on the final whorl. The number of basal cords varies from 0 to 9.

ABBOTT (1974) listed *Margarites minutissima* Mighels as a good species. However, judging from the original illustration, it may clearly be assigned to the synonymy of *Moelleria costulata*, as suggested by MACPHERSON (1971).

### Genus *Spiromoelleria* gen. nov.

Type species: *Moelleria quadrae* Dall, 1897. Alaska.

**Description:** Shell umbilicate; whorl circular in cross section; suture deeply impressed. Sculpture of regular spiral cords on entire body whorl and evenly rounded base; axial sculpture lacking. Calcareous operculum multispiral on both sides, not retractable deeper than aperture.

*Spiromoelleria* differs from *Moelleria* in lacking wavy axial sculpture. That there are two species is a strong point in support of the need for generic separation from *Moelleria*.

The two species of *Spiromoelleria* differ in shell proportions and in the strength of spiral sculpture. The distribution of this genus is limited to the northern Pacific.

#### *Spiromoelleria quadrae* (Dall, 1897)

(Figures 5, 7, 8)

"*Mölleria quadrae* Dall": NEWCOMB, 1896:19 [*nomen nudum*].

*Molleria quadrae* DALL, 1897:15, pl. 1, figs. 14, 14a; WILLETT, 1919:26; DALL, 1921:174; OLDROYD, 1924:170, pl. 44, figs. 7, 8.

*Mölleria quadrae*: OLDROYD, 1927:171, pl. 91, figs. 11, 11a; KEEN, 1937:41; LAROCQUE, 1953:135.

*Moelleria quadrae*: BURCH, 1946:26; EYERDAM, 1960:93; BERNARD, 1970:79; ABBOTT, 1974:61; GOLIKOV & GULBIN, 1978:183.

*Moelleria (Spiromoelleria) quadrae*: BAXTER, 1983:28.

*Mölleria drusiana* DALL, 1919:358; OLDROYD, 1927:172; KEEN, 1937:41; LAROCQUE, 1953:135.

*Molleria drusiana*: DALL, 1921:174.

*Moelleria drusiana*: BURCH, 1946:26; EYERDAM, 1960:93; ABBOTT, 1974:61.

**Description:** Shell minute, depressed turbinata, broadly umbilicate; aperture and whorls circular, peritreme complete, suture deeply impressed, lip thin. Whorls 3.5; axial sculpture of weak, irregular growth increments only; spiral sculpture of variable number (49–77) of fine, narrow cords; spiral cords present throughout, from suture to umbilical walls, stronger on base, with wider interspaces on base. Color tan or whitish, rarely stained with rust. Oper-

culum calcareous, outer surface concave, with up to 6 evenly expanding volutions in multispiral pattern.

**Dimensions:** Illustrated specimen (Figure 5): height 1.68 mm, diameter 2.46 mm. Shell height 68% of diameter.

**Distribution and habitat:** North Pacific Ocean: Kuril Islands (GOLIKOV & GULBIN, 1978); Aleutian Islands (LACM: Attu, Amchitka); Kodiak Island (LACM); Kachemak Bay, Cook Inlet (RB, LACM); Prince William Sound (RB), Southeastern Alaska (WILLETT, 1919); Cumshewa Inlet, British Columbia (type locality). On undersides of rocks at low tide, on gravel or muddy, shell bottoms to 30 m. Common in intertidal zone in Kachemak Bay, Cook Inlet, Alaska; more frequent in the subtidal zone in southeastern Alaska. GOLIKOV & GULBIN (1978) reported it at 20 m, Simushir Island, Kuril Islands (approximately 47°N, 152°E).

**Type material and type localities:** *Moelleria quadrae*: USNM 107411, 18–27 m, Cumshewa Inlet, Queen Charlotte Islands, British Columbia (approximately 53°N, 132°W); collected by C. F. Newcombe. *Moelleria drusiana*: USNM 31117, intertidal, Constantine Harbor, Amchitka Island, Aleutian Islands, Alaska; collected by W. H. Dall.

**Remarks:** Although DALL (1919) reported that *Moelleria drusiana* has the "surface smooth except for microscopic incremental lines," there are 42 fine spiral striae on the final whorl of the holotype. The holotype is clearly an immature specimen of *M. quadrae*, 1.1 mm in height and 1.5 mm in diameter.

#### *Spiromoelleria kachemakensis*

Baxter & McLean, spec. nov.

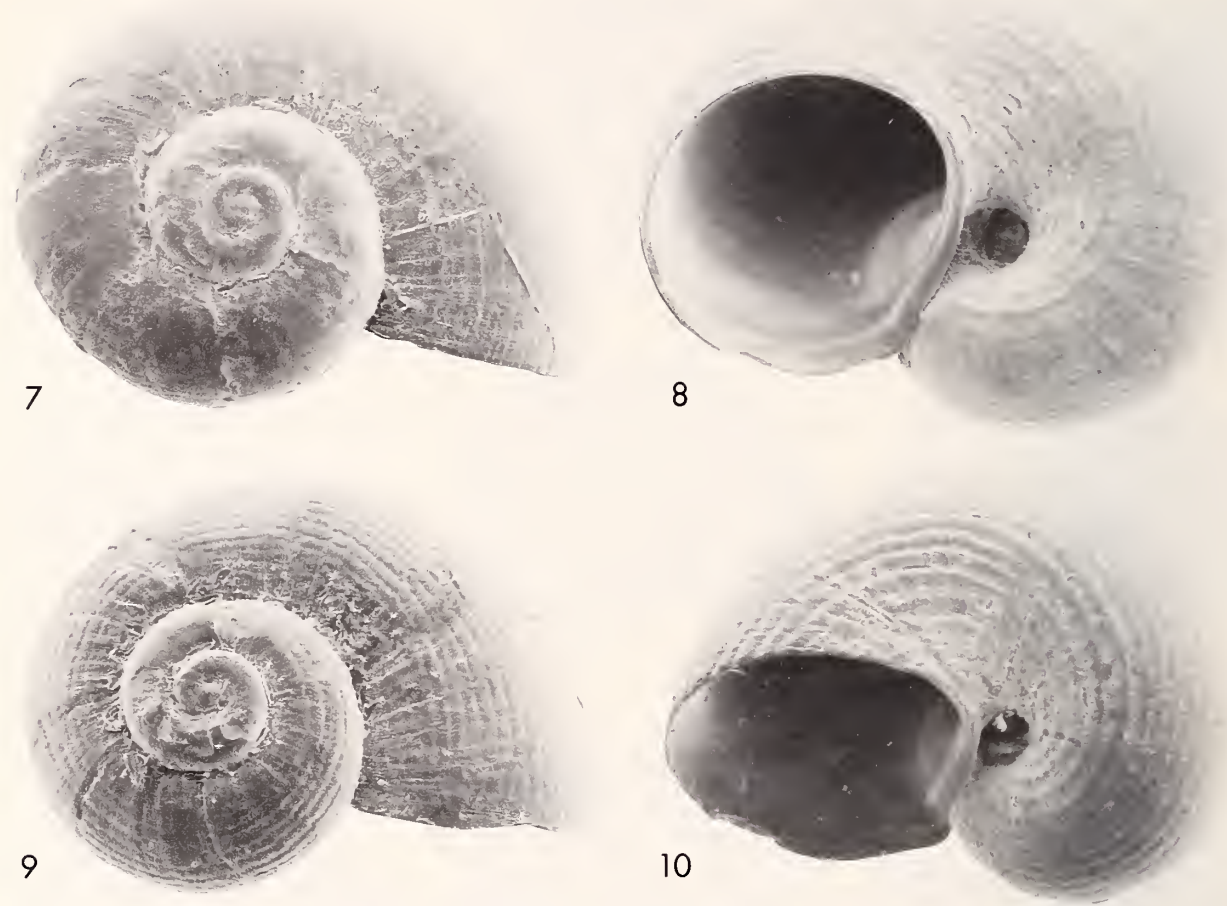
(Figures 1, 6, 9, 10)

*Moelleria (Spiromoelleria) kachemakensis*: BAXTER, 1983:28 [*nomen nudum*].

**Description:** Shell minute, turbinata, deeply umbilicate, aperture and whorls circular, peritreme complete, suture deeply impressed, lip thin. Whorls 3.4 to 3.7; axial sculpture of irregular growth increments only; spiral sculpture of 35–53 flat-topped cords on final whorl; spiral cords increasing in number by emergence between existing ribs; ribs faint near suture, strong and with narrow interspaces on upper surface of body whorl, with broader interspaces on lower surface. Color white to light tan, surface often stained rust to black. Operculum calcareous, multispiral, outer surface concave, with 6 evenly expanding volutions, not retracting within aperture.

**Dimensions:** Holotype: height 1.82 mm, diameter 2.24 mm; height 81% of diameter.

**Type material:** 12 live-collected specimens from the type locality, dredged by Baxter & McLean, 2 August 1973. Holotype LACM 1989; 5 paratypes LACM 1990, 2



## Explanation of Figures 7 to 10

Figure 7. *Spiromoelleria quadrae* (Dall, 1897). Dorsal view, SEM. LACM 103331a, intertidal, Jakalof Bay, Kachemak Bay, Cook Inlet, Alaska. Height 1.48 mm, diameter 2.20 mm.

Figure 8. *Spiromoelleria quadrae* (Dall, 1897). Basal view, SEM. LACM 103331b, as same locality as Figure 7. Specimen subsequently lost.

Figure 9. *Spiromoelleria kachemakensis* spec. nov. Dorsal view, SEM. LACM 103332a, same locality as Figure 7. Height 1.80 mm, diameter 2.18 mm.

Figure 10. *Spiromoelleria kachemakensis* spec. nov. Basal view, SEM. LACM 103332b, same locality as Figure 7. Height 1.68 mm, diameter 2.06 mm.

paratypes CAS 029766, 2 paratypes USNM 804405, 2 paratypes NMC 86526, 1 paratype RB B461-12.

**Type locality:** 9 m on mud-shell bottom, off northwest side Hesketh Island, Kachemak Bay, Cook Inlet, Alaska (59°30'31"N, 151°30'01"W). The name of the species is based on the type locality.

**Distribution:** Kachemak Bay, Cook Inlet; along the Kenai Peninsula; Prince William Sound; east to Rush Bay, Glacier Bay, southeastern Alaska (58°28'N, 136°04'W) (UAF M2671, collected by George Mueller). Not collected at Kodiak Island or to the west. Living specimens have been collected by Baxter at or near the type locality and at Port Dick on the south side of the Kenai Peninsula (59°13'N, 151°03'W). Living on undersides of rocks at

low tide to 45 m on gravel or muddy, shell bottoms, particularly at the base of vertical drop-offs.

**Remarks:** *Spiromoelleria kachemakensis* has a higher spire (shell height 81% of diameter, compared to 68%), a narrower umbilicus, and more prominent spiral cords than *S. quadrae*. There are no intergrading specimens.

The small turbinid *Homalopoma lacunatum* (Carpenter, 1864), which occurs from Alaska to Washington, differs in having a larger, thicker shell, a less impressed suture and opercular volutions that are paucispiral.

We have no records of the three species occurring at the same station, as *Spiromoelleria quadrae* has been taken only intertidally and *Moelleria costulata* only subtidally in Kachemak Bay. However, *S. quadrae* and *S. kachemakensis* were collected together at low tide (near the type

locality of *S. kachemakensis*) at the west end of Yukon Island, Kachemak Bay (59°31.5'N, 151°29.5'W) by Baxter & McLean in August 1973. Living specimens of *M. costulata* were collected offshore with *S. kachemakensis* at the type locality.

MACNEIL *et al.* (1943) illustrated an eroded fossil specimen of *Spiromoelleria* from a raised terrace at Nome, Alaska, which they identified as "*Molleria* n. sp.?" Although its proportions are similar to those of *S. kachemakensis*, the specimen (USNM 499052) is much larger (dimensions: height 2.96 mm, diameter 3.40 mm) than known for *S. kachemakensis*. In size it is comparable to *Homalopoma lacunatum*, but it has the deeply impressed suture of the genus *Spiromoelleria*. We refrain from further treating this specimen in the absence of more and better preserved material.

#### ACKNOWLEDGMENTS

Collectors who have contributed to the distributional information recorded here include David Lindberg, George Mueller, Charles O'Claire, Paul Scott, and the late Robert Talmadge. We thank Joseph Rosewater (USNM) and Barry Roth (CAS) for access to collections. SEM photos of radulae were generously provided by Carole S. Hickman. Photographs of shells are the work of Bertram C. Draper. Paul Greenhall and Cynthia Gust (USNM) provided the SEM views of shells. We thank Eugene Coan and Carole Hickman for reading the manuscript and offering helpful suggestions.

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